ASSESSING THE ROLE OF DIGITAL TECHNOLOGY ADOPTION IN HEALTHCARE SECTOR OF UTTAR PRADESH

Synopsis

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1. Introduction

1.1 Healthcare Sector in India

Healthcare is the prevention, treatment, and management of illness and the preservation of mental and physical well-being through the services offered by the medical, nursing, and allied health professions. According to the World Health Organization, health care embraces all the goods and services designed to promote health, including “preventive, curative and palliative interventions, whether directed to individuals or to populations”. The organized provision of such services may constitute a health care system. Health is defined as a state of complete physical, mental and social well-being and just not the non-existence of disease or ailment. Health is a primary human right and has been accorded due importance by the Constitution through Article 21. Recognizing the critical role played by the Health Industry, the industry has been conferred with the infrastructure status under section 10(23G) of the Income Act.

The Indian Health sector consists of

- Medical care providers like physicians, specialist clinics, nursing homes, hospitals.
- Diagnostic service centers
- Pathology laboratories.
- Medical equipment manufacturers.
- Contract research organizations (CRO's).
- Pharmaceutical manufacturers .
- Third party support service providers (catering, laundry).

1.1.1 Traditional Healthcare Systems in India

In India, in addition to existence of modern medicine, indigenous or traditional medical practitioners continue to practice throughout the country. Popular indigenous healthcare traditions include Ayurveda, Siddha, Unani, Homeopathy, Naturopathy, and Yoga.

The Ayurveda (meaning science of life) system deals with causes, symptoms, diagnoses, and treatment based on all aspects of well-being (mental, physical, and spiritual). These professionals, traditionally, have been inheriting the skills from their ancestors. However, with the advent of education, a variety

of institutions offer training in indigenous medical practice.

The Siddha system defines disease as the condition in which the normal equilibrium of the five elements in human beings is lost resulting in different forms of discomfort. The diagnostic methods in Siddha medical system are based more on the clinical acumen of the physician after observation of the patient, pulse and diagnosis and clinical history.

Yoga is a science as well an art of healthy living physically, mentally, morally and spiritually. Yoga is believed to be founded by saints and sages of India several thousand years ago. Yoga has its origin in the Vedas, and its philosophy is an art and science of living in tune with the universe. Yogis gave rational interpretation of their experiences about Yoga and brought a practically sound and scientifically prepared method within every one's reach.

Naturopathy has several references in the Vedas and other ancient texts, which indicate that these methods were widely practised in ancient India. Naturopathy believes that all the diseases arise due to accumulation of morbid matter in the body and if scope is given for its removal, it provides cure or relief. It also believes that the human body possesses inherent self- constructing and self-healing powers. Naturopathy differs slightly with other systems of medicine, as it does not believe in the specific cause of disease and its specific treatment but takes into account the totality of factors responsible for diseases such as one's in-natural habits in living, thinking, working, sleeping, or relaxation, and the environmental factors that disturbs the normal functioning of the body.

Unani system of medicine believes that the body is made up of four basic elements viz., earth, air, water and fire, which have different temperaments i.e. cold, hot, wet and dry. After mixing and interaction of four elements a new compound having new temperament comes into existence i.e. hot-wet, hot-dry, cold-wet and cold-dry. The body has simple and compound organs, which got their nourishment through four humours, viz. blood, phlegm, yellow bile, black bile. Unani system of medicine believes in promotion of health, prevention of diseases and cure. In addition to such healthcare systems, there are also faith / spiritual healers, who are largely present in rural parts of India. Some spiritual leaders use one or more of the traditional therapies, viz, Ayurveda, Yoga or Naturopathy as one of the healing modes to cure their clients.

1.1.2 Modern (Allopathic) Healthcare Systems in India

The modern (allopathic) health care system in India consists of a public sector, a private sector, and an informal network of care providers. The size, scale, and spread of the country hampered complete adherence to the number of well-intended guidelines and regulations. Although there are norms and guidelines, compliance is minimal. In reality, the sector operates in a largely unregulated environment, with minimal controls on what services can be provided by whom, in what manner, and at what cost. Thus, wide disparities occur in access, cost, levels, and quality of health services provided across the country.

1.2 GDP and Economic Impact of Healthcare Sector

The healthcare sector has a substantial economic impact on a country's Gross Domestic Product (GDP) and overall economy. National Health Policy, 2017 which envisages "the attainment of the highest possible level of health and well-being for all at all ages, through a preventive and pro-motive healthcare orientation in all developmental policies, and universal access to good quality healthcare services without anyone having to face financial hardship as a consequence. This would be achieved through increasing access, improving quality, and lowering the cost of healthcare delivery."

Accordingly, the Policy recommended an increase in the Government's health expenditure from the existing 1.2 per cent to 2.5 per cent of GDP by 2025. Also, the Fifteenth Finance Commission, in its report, had recommended that public health expenditure of Union and States together should be increased in a progressive manner to reach 2.5 per cent of GDP by 2025 (FFC report, para 9.41, iii). In keeping with this objective, **Central and State Governments' budgeted expenditure on the health sector (Table 1) reached 2.1 per cent of GDPin FY23 (BE) and 2.2 per cent in FY22 (RE), against 1.6 per cent in FY21.**

Table 1: Budget Expenditure

Items	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**
Total Expenditure (in crores)	3760611	4265969	4515946	5040747	5410887	6353359	7453320	8008684
Expenditure on Social S.	915500	1040620	1139524	1278124	1364906	1479389	1944013	2132059
of which:								
Health	175272	213119	243388	265813	272648	317687	516427	548855
As per cent of GDP								
Expenditu	6.6	6.8	6.7	6.8	6.8	7.5	8.2	8.3

re on Social S.								
of which:								
Health	1.3	1.4	1.4	1.4	1.4	1.6	2.2	2.1
As per cent of total expenditure								
Expenditure on Social S.	24.3	24.4	25.2	25.4	25.2	23.3	26.1	26.6
of which:								
Health	4.7	5.0	5.4	5.3	5.0	5.0	6.9	6.9
As per cent of social S.								
Health	19.1	20.5	21.4	20.8	20.0	21.5	26.6	25.7

(Source: Budget Documents of Union and State Governments)

The National Health Account (NHA) estimates for FY19 show that there has been an increase in the share of Government Health Expenditure (GHE) in the total GDP from 1.2 per cent in FY14 to 1.3 per cent in FY19. Additionally, the share of GHE in Total Health Expenditure (THE) has also increased over time, standing at 40.6 per cent in FY19, substantially higher than 28.6 per cent in FY14.

Overall, for FY19, Total Health Expenditure (THE) for India is estimated to be Rs.5,96,440 crore (3.2 per cent of GDP and Rs.4,470 per capita). Current Health Expenditure (CHE) is Rs.5,40,246 crore (90.6 per cent of THE) and capital expenditures are Rs.56,194 crore (9.4 per cent of THE). Of the Government Health Expenditure (GHE), the Union Government's share is 34.3 per cent and the State Governments' share is 65.7 per cent.

In sync with the focus on providing healthcare services to all, which comprises one of the policy recommendations of the National Health Policy 2017, the Government is focusing on primary healthcare expenditure which has increased from 51.1 per cent in FY14 to 55.2 per cent in FY19. This not only ensures quality services at the grassroots level but also reduces the chances of ailments requiring secondary or tertiary healthcare services. Between FY14 and FY19, the share of primary and secondary care in the GHE increased from 74.4 per cent to 85.7 per cent. On the other hand, the share of primary and secondary care in private health expenditure has declined from 82.0 per cent to 70.2 per cent during the same period.

The social security expenditure on health, which includes the social health insurance programme, government-financed health insurance schemes, and medical reimbursements made to government

employees, has increased from 6 per cent in FY14 to 9.6 per cent in FY19. The Economic Survey notes that this is a significant increase which shows that the citizens are better equipped and better provided in terms of healthcare at their doorstep making it more accessible. Due to several such steps, Out-of-Pocket Expenditure (OOPE) as a percentage has declined substantially from 64.2 per cent in FY14 to 48.2 per cent in FY19.

1.3 Digital Technology

Digital technology is of paramount importance in today's world due to its far-reaching impact on various aspects of society, the economy, and individual lives. Digital technology has fundamentally transformed the way we live, work, communicate, and interact with the world around us. It has become an integral part of modern life, shaping our society, economy, and daily experiences in profound ways. Digital technology streamlines processes and automates tasks, significantly enhancing efficiency and productivity across industries. Businesses can optimize operations, reduce costs, and increase output, resulting in economic growth and improved competitiveness. Digital technology provides unprecedented access to vast amounts of information and knowledge. Online resources, search engines, and educational platforms empower individuals to learn, research, and stay informed like never before, narrowing the information gap.

Digital technology provides unprecedented access to vast amounts of information and knowledge. Online resources, search engines, and educational platforms empower individuals to learn, research, and stay informed like never before, narrowing the information gap. Digital technology revolutionizes education, making learning more accessible and interactive. Online courses, e-learning platforms, and educational apps empower individuals to acquire new skills and credentials. Digital technology can enhance safety and security. Surveillance systems, emergency alert systems, and IoT-enabled safety devices contribute to public safety and disaster management. Digital technology has revolutionized the entertainment industry, enabling the creation and distribution of content in various formats, from streaming movies to interactive video games.

Digital technology enhances the quality of life by providing tools and services that cater to personal well-being, entertainment, and convenience, such as fitness apps, entertainment streaming, and smart home devices. In essence, digital technology underpins modern society, shaping the way we live, work,

and interact. Its importance lies in its transformative potential to drive economic growth, improve access to information and services, foster innovation, and enhance the overall quality of life.

1.4 Digital Technology Adoption

Digital Technology Adoption (DTA) refers to the process by which individuals, organizations, industries, or societies integrate and make use of digital technologies in various aspects of their operations and activities. This adoption can encompass a wide range of digital tools, platforms, and technologies, and it can have a transformative impact on how things are done.

Here are key points about Digital Technology Adoption:

Integration of Digital Tools: DTA involves the integration and utilization of digital tools and systems, such as computers, software applications, mobile devices, and internet-based services, to enhance efficiency, productivity, and innovation.

Organizational and Cultural Shift: It often requires not just technological changes but also shifts in organizational culture and processes. Successful DTA often involves embracing a culture of innovation, adaptability, and continuous learning.

Enhanced Efficiency and Productivity: One of the primary motivations behind DTA is to improve efficiency and productivity. Digital technologies can automate tasks, streamline processes, and reduce manual labor, leading to cost savings and improved output.

Data-Driven Decision-Making: DTA relies on the collection and analysis of digital data to inform decision-making. Organizations use data analytics and insights to make informed choices and optimize their strategies.

Enhanced Customer Experiences: DTA can lead to improved customer experiences through digital channels. This includes personalized marketing, online customer support, and user- friendly interfaces that cater to customer preferences.

Digital Transformation: DTA is often a crucial component of broader digital transformation initiatives. Organizations seek to adapt and evolve in response to changing market dynamics and customer expectations.

Innovation and Competitive Advantage: By adopting digital technologies, businesses and industries can stay competitive and innovate in their respective fields. This can lead to the development of new

products, services, and business models.

Challenges and Considerations: While DTA offers numerous benefits, it also presents challenges such as cyber security concerns, data privacy issues, and the need for digital literacy and training.

Societal Impact: DTA extends beyond the business realm and influences society at large. It affects how people communicate, access information, and engage with various services, from healthcare to education.

Continuous Process: DTA is not a one-time event but an ongoing process. As technology evolves, organizations and individuals must adapt and continue to embrace new digital tools and capabilities.

Equity and Access: Ensuring equitable access to digital technologies and bridging the digital divide are important considerations in DTA to avoid leaving marginalized populations behind.

Regulatory Frameworks: Many governments have established regulatory frameworks and policies to govern DTA, especially concerning data protection, consumer rights, and cyber security.

Digital Technology Adoption is a dynamic and evolving concept that shapes how we live, work, and interact in our increasingly digitized world. It plays a pivotal role in driving innovation, economic growth, and societal change.

1.4.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a widely recognized theoretical framework used to understand and predict how individuals adopt and use technology. Developed by Fred Davis in the late 1980s, TAM is particularly relevant in the fields of information systems, technology management, and human-computer interaction. The TAM model proposes that perceived ease of use and perceived usefulness directly impact an individual's intention to use a technology, which, in turn, influences their actual use of the technology. The model is often depicted as a diagram, illustrating these relationships.

TAM has been widely applied in various contexts, including the introduction of new software, hardware, and digital services. Organizations use TAM to assess user acceptance, predict technology adoption rates, identify barriers to adoption, and design user-friendly interfaces or systems that promote technology adoption.

According to TAM, technology acceptance is a three-stage process, whereby external factors (system design features) trigger cognitive responses (perceived ease of use and perceived usefulness), which, in

turn, form an effective response (attitude toward using technology/intention), influencing use behaviour (Davis, 1989; Davis, 1993). TAM represents the behaviour, as the outcome predicted by perceived ease of use, perceived usefulness and behavioural intention. Perceived ease of use and perceived usefulness capture the expectations of positive behavioural outcomes and the belief that behaviour will not be labour-consuming (Davis, 1989). According to a follow-up study, behavioural intention can be substituted by the attitude toward behaviour (Davis, 1993), which is an affective evaluation of the potential consequences of the behaviour (Ajzen, 2011). The higher the affective response, the higher is the likelihood that the behaviour will take place. The effect of perceived usefulness on actual use can be direct, which underscores the importance of the variable in predicting behaviour. Although perceived ease of use does not affect use behaviour directly, it underpins the effect of perceived usefulness (Davis, 1993). The model implies that if an application is expected to be easy to use, the more likely it is that it will be considered useful for the user and the more likely it is that this will stimulate the acceptance of the technology (Davis, 1989; Davis, 1993).

The development of the model and measures for technology acceptance have made significant theoretical contributions and have had a great practical value.

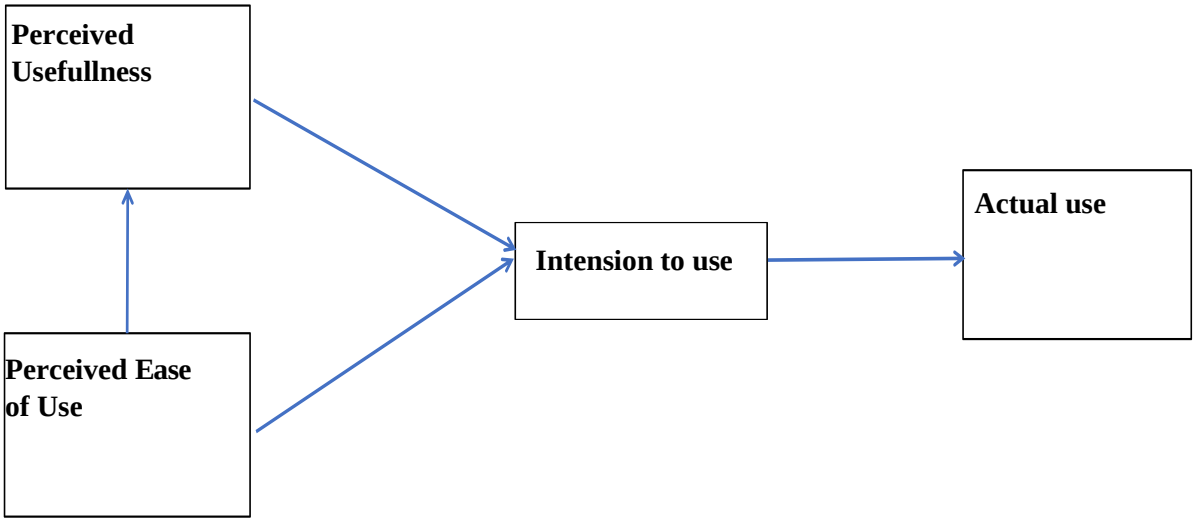

Figure1: Technology Acceptance Model
(Source: https://open.ncl.ac.uk/)

1.5 Digital tools applied in Healthcare Sector

The healthcare sector has witnessed a significant transformation in recent years due to the integration of various tools and technologies. These advancements have improved patient care, enhanced

operational efficiency, and enabled more effective disease management. Here are some of the various tools and technologies being used in the healthcare sector:

- **Electronic Health Records (EHRs):** EHR systems digitize patient records, making them easily accessible to authorized healthcare professionals. They improve data accuracy, streamline workflow, and enhance patient care coordination.
- **Telemedicine and Telehealth:** Telemedicine platforms enable remote consultations between patients and healthcare providers, increasing access to medical care, particularly in remote or under served areas.
- **mHealth Apps:** Mobile health apps offer a wide range of functionalities, including appointment scheduling, medication reminders, fitness tracking, and chronic disease management.
- **Wearable Health Devices:** Devices like smartwatches and fitness trackers monitor vital signs, physical activity, and sleep patterns, allowing individuals to track and manage their health in real-time.
- **Artificial Intelligence (AI):** AI technologies are used for tasks such as medical image analysis, drug discovery, predictive analytic, and clinical decision support. They enhance diagnostic accuracy and treatment recommendations.
- **Robotic Surgery:** Surgical robots like the da Vinci Surgical System assist surgeons in performing minimally invasive procedures with enhanced precision and smaller incisions.
- **IoT (Internet of Things) Devices:** IoT devices collect and transmit patient data in real- time, enabling remote monitoring of vital signs and early intervention for chronic conditions.
- **3D Printing:** 3D printing technology is used to create custom implants, prosthetics, and anatomical models for surgical planning, resulting in improved patient outcomes.
- **Block chain:** Block chain technology enhances data security and interoperability by enabling secure and transparent data sharing among healthcare providers while ensuring data integrity.
- **Clinical Decision Support Systems (CDSS):** CDSS software provides evidence-based clinical recommendations to healthcare professionals, aiding in diagnosis and treatment decisions.
- **Health Information Exchange (HIE) Systems**: HIE systems facilitate secure sharing of patient health information among different healthcare organizations, improving care coordination.
- **Biometric Authentication**: Biometric tools, such as fingerprint and facial recognition, are used for

secure patient identification and access control in healthcare settings.

- **Data Analytic and Big Data:** Advanced analytics tools help healthcare organizations derive insights from large datasets, leading to improved population health management and personalized care.
- **Genomics and Precision Medicine:** Genomic sequencing technologies enable personalized treatment plans based on an individual's genetic profile, improving treatment efficacy.
- **Patient Portals**: Secure online portals allow patients to access their medical records, schedule appointments, and communicate with healthcare providers.
- **Medical Simulation:** Simulation technologies are used for medical training and education, allowing healthcare professionals to practice procedures in a safe and controlled environment.
- **Remote Monitoring and IoT:** Remote monitoring solutions, integrated with IoT devices, enable healthcare providers to track patient health remotely, reducing hospital readmission and improving outcomes.
- **Augmented Reality (AR) and Virtual Reality (VR):** AR and VR technologies find applications in medical training, patient education, and surgical planning, providing immersive experiences for users.

2. Review of literature

The present literature review focuses on three main constructs of interest in the context of this proposed research: Digital Technologies, eHealth/miHealth, Technology Acceptance Model (TAM), Electronic Health Record (EHR)

2.1 Digital Technologies

Gagnon & M. P., (2009) carried out a systematic review of the effectiveness of interventions to promote the adoption of ICT by healthcare professionals. Search methods—Specific strategies, defined with the help of an information specialist, were used to search the Cochrane Effective Practice and Organization of Care Group (EPOC) register and additional relevant databases. We considered studies published from January 1990 until October 2007.

Selection criteria—Randomised controlled trials (RCTs), controlled clinical trials (CCTs), controlled before/after studies (CBAs), and interrupted time series (ITS) that reported objectively measured

outcomes concerning the effect of interventions to promote adoption of ICT in healthcare professionals' practices.

Laurenza, E., (2018) contributed to the extant literature regarding the exploitation of digital technologies by illustrating how this type of IT can influence business process improvements in the healthcare industry. The paper reports an illustrative case study for MSD Italy, the Italian subsidiary of the USA-based company Merck & Co., Inc. The group sells drugs for human use in Italy but is also active in the veterinary (MSD Animal Health) industry, with Vree Health, and in solutions and software-based services for the healthcare industry. The results show that the adoption of digital technologies could improve the performance of main healthcare business processes, particularly those processes that can be simplified with the adoption of information technology. More specifically, digital technologies could increase efficiency and, at the same time, allow for the delivery of better quality and reduced response times, with many benefits for several stakeholders, such as national health systems, clinicians and patients.

Tobias Krick & Kai Huter (2019) evaluated the map the field of digital technologies for informal and formal care that have already been explored in terms of acceptance, effectiveness and efficiency and to show the scope of the used methods, target settings, target groups and fields of support. In this study a three-step methodology has been applied for the testing and confirmation of the theory and for accessing the convergent and discriminant validity Q sort method was used. The study concludes a theoretical understanding of digitized technology adoption, patient-physician involvement, physician knowledge sharing, agile decision making and care service efficiency.

Areej Al Hogail & Mona AlShahrani (2019) conducted a study to provide comprehensive view for IoT adoption about related factors that affect the consumers' trust of IoT services and products & evaluated how factors might be useful to implement marketing strategies focused on consumer's demands and requirements. This paper developed a conceptual trust model that contains the major factors affecting trust towards IoT technology adoption. The model is presented in three domains and 11 dimensions and designed based on the theory of Technology Acceptance Model (TAM). It provided a conceptual framework that classified the factors into three main domains, namely: product related factors, social influence related factors and Security Related Factor

Shahrokh Nikoua & Wirawan Agaharib (2019) developed theoretical model of adoption of digital healthcare technologies that support independent living applying the CA framework. Researcher followed a mixed-methods approach with a sequence of qualitative, quantitative, and qualitative methods. This paper contributed to the understanding of intentions to use digital healthcare technologies by first applying the CA framework for theorizing on expected outcomes on the level of improved quality of life rather than facilitation of specific activities.

Isabel C. P. Marques1 & João J. M. Ferreira (2019) explored the potential of existing digital solutions to improve the quality and safety of healthcare and analyse the emerging trend of digital medicine. Systematic Literature Review (SLR) of the period 1973–2018. To select articles, a prioritization index is proposed, aggregating the characteristics of the score of journals (2017 basis), number of article citations and year of publication, through the Simple Multi-attribute Rating Technique Exploiting Ranks (SMARTER) method. Of the 749 articles listed, 53 were selected and analysed. This study revealed great possibilities for SLR with the use of Simple Multi-attribute Rating Technique Exploiting Ranks (SMARTER)

Colicchio, T. K., Cimino, J. J., & Del Fiol, G. (2019) discussed the most prominent UCs of Meaningful Use: the hype around HIT, EHR market saturation, innovation vacuum, physician burnout, and data obfuscation. Researcher identified challenges resulting from these UCs and provide recommendations for future research in order to empower the broader medical and informatics communities to realize the full potential of a now digitized health system. We believe that fixing these unanticipated effects will demand efforts from diverse players such as health care providers, administrators, HIT vendors, policy makers, informatics researchers, funding agencies, and outside developers; promotion of new business models; collaboration between academic medical centers and informatics research departments; and improved methods for evaluations of HIT.

Dana Alrahbi, Mehmood Khan (2019) identified and examined and place in a hierarchical structure, based on a two-step exploratory methodology, the motivators for IT adoption of four main categories of healthcare stakeholders (employees, patients, UAE citizens and residents, and accredited foresight experts Analytic Hierarchy Process (AHP) model has been used for achieving the objective. AHP revealed the relative importance weights of the seven IT adoption motivators and their 41 sub-

motivators. Government support was found to be the most important group of motivators, followed by knowledge sharing, infrastructure, green management, lean management, internal/external environment, and social sustainability.

Davide Golinelli, Erik Boetto (2020) aimed to describe which digital solutions had been reported in the scientific literature and to investigate their potential impact in the fight against the COVID-19 pandemic. The researcher has conducted a literature review searching PubMed and MedrXiv with terms considered adequate to find relevant literature on the use of digital technologies in response to COVID-19. The researcher has developed an impact score to evaluate the potential impact on COVID-19 pandemic of all the digital solutions addressed in the selected papers. The researcher founds that digital solutions and innovative technologies have mainly been proposed for the diagnosis of COVID-19 & also identified numerous suggestions on the use of artificial-intelligence-powered tools for the diagnosis and screening of COVID-19.

Tortorella, G. L., (2020) examined the effect of five contingency factors on the adoption of H4.0 technologies and associated barriers to H4.0 adoption in emerging economies; they are: hospital's ownership and age, number of employees, number of inpatient beds, and functionality (teaching hospital or not). The analysis is based on a transnational survey with 159 middle and senior managers from 16 hospitals, located in Brazil, India, Mexico and Argentina. Results indicate that contingencies do affect both H4.0 technologies adoption and associated barriers although not homogeneously in terms of effect, being more prominent on technologies' adoption than on barriers to H4.0 implementation. Study sheds light on these relationships, providing hospitals' managers a means to anticipate potential issues and handle eventual difficulties inherent to the context in which they are inserted.

Guilherme Luz Tortorella (2021) examined the effect of five contingency factors on the adoption of H4.0 technologies and associated barriers to H4.0 adoption in emerging economies Transnational survey with 159 middle and senior managers from 16 hospitals, located in Brazil, India, Mexico and Argentina has been used to analyze the objective. Results indicated that contingencies do affect both H4.0 technologies adoption and associated barriers although not homogeneously in terms of effect, being more prominent on technologies' adoption than on barriers to H4.0 implementation.

Ijaz, Faiza, Chaudhry, (2021) examined the impact of IT launch, technical support regarding IT, and

the length of IT usage on healthcare outcomes including patient safety and quality of care and also examined the health information technology adoption as a mediator in this research model. The researcher has collected data through questionnaire from people working in the health sector of Pakistan. Data was analysed by using two statistical software SPSS and AMOS covering descriptive analysis, confirmatory factor analysis, and structural equation modelling. It has been found that IT launch and Length of IT has a positive and significant impact on patient safety and quality of care. The technical support regarding IT has a positive and significant impact on patient safety but an insignificant impact on the quality of care.

Sarah T. H. et al (2021) studied the challenges faced to adapt the elderly for the digital revolution while ensuring dignified aging. While the healthcare industry accelerates its study and use of health technologies to improve diagnostics, treatment, and the quality of life of those in the aging category, the elderly socially construct these technological insertions that challenge the dominant understandings of what these technologies can do for their health outcomes. The study reveals re-constructions of these technological insertions through the voice of the elderly in their negotiations with health technologies in their everyday lives. Here, narratives reveal key themes that proliferate technology negotiation as barriers to everyday lived experiences.

V. M., Saurin, (2021) presented an exploratory investigation of the upside of ten digital technologies derived from Healthcare 4.0 (H4.0) in terms of their perceived contribution to six healthcare services and the four abilities of resilient healthcare: monitor, anticipate, respond, and learn. This contribution was assessed through a multinational survey conducted with 109 experts. Emergency rooms (ERs) and intensive care units (ICUs) stood out as the most benefited by H4.0 technologies. That is consistent with the high complexity of those services, which demand resilient performance. Four H4.0 technologies were top ranked regarding their impacts on the resilience of those services. They are further explored in follow-up interviews with ER and ICU professionals from hospitals in emerging and developed economies to collect examples of applications in their routines.

2.2 Technology Acceptance Model

Krishnamurthy et el, (2016) have analyzed the application of the Technology Acceptance Model (TAM), to health care. This study proposed a theoretical framework that includes the core constructs in

TAM: namely, perceived ease of use and perceived usefulness. Additional external variables were also adopted— namely, customized information and Trustworthiness. The overall research model suggests that all mentioned variables either directly or indirectly affect the level of information by social media from they got to use an out-patient's acceptance of technology in private hospital sectors. Based on data collected from 200 out- patient in private hospital in Chennai city, Exploratory factor analysis were used to identify the factors are influenced to acceptance of technology in out-patient of private hospital sectors.

Rahimi, (2018) have reviewed published research on TAM use in health information systems development and implementation with regard to application areas and model extensions after its initial introduction. The Researchers have reviewed 134 articles in this area. These articles were appraised and divided into three categories according to research topic: studies using the original TAM, studies using an extended TAM, and acceptance model comparisons including the TAM. The review identified three main information and communication technology (ICT) application areas for the TAM in health services: telemedicine, electronic health records, and mobile applications. The review results indicate a continuous progress, there are still areas that can be expanded and improved to increase the predictive performance of the TAM.

M. Nguyen, & J. Fujioka, (2020) study aimed to explore both health care provider and administrator perceptions regarding the usefulness and ease of using technology in palliative care. In this study the Technology Acceptance Model was used to provide theoretical framework into two key determinants that influence user acceptance of technology. Inductive thematic analysis was used to analyse the interview data. Researchers found that participants' perspectives of technology acceptance in palliative care were largely dependent on their potential to help address major challenges in the field without imposing significant burden on providers and patients.

AlQudah et el. (2021) have systematically review the articles published on technology acceptance in healthcare. From a yield of 1768 studies collected, 142 empirical studies have met the eligibility criteria and were extensively analyzed. The key findings confirmed that TAM and UTAUT are the most prevailing models in explaining what affects the acceptance of various healthcare technologies through different user groups, settings, and countries. Apart from the core constructs of TAM and UTAUT, the

results showed that anxiety, computer self-efficacy, innovativeness, and trust are the most influential factors affecting various healthcare technologies. The results also revealed that Taiwan and the USA are leading the research of technology acceptance in healthcare, with a remarkable increase in studies focusing on telemedicine and electronic medical records solutions.

Guohong Li, (2022) aimed to explain the micro-mechanism that determines the adoption intention of IHT from the perspective of healthcare professionals based on the unified theory of the Value-based Adoption Model (VAM) and employee burnout. We conduct a cross- sectional online survey using a sample of 12,031 healthcare professionals selected through multistage cluster sampling from three provinces in mainland China. The hypotheses of our research model are developed based on the VAM and employee burnout. Structural equation modelling is then used to test the research hypotheses. The results indicate that perceived usefulness, perceived enjoyment, and perceived complexity positively correlate with perceived value respectively). Perceived value, perceived enjoyment, and employee burnout are the most important determinants of IHT adoption intention by healthcare professionals. In addition, while employee burnout is negatively related to adoption intention, perceived value inhibits employee burnout. Therefore, it is necessary to develop strategies to improve the perceived value and reduce employee burnout, which will benefit the promotion of the adoption intention of IHT in healthcare professionals. Our study supports the use of the VAM and employee burnout in explaining healthcare professionals' adoption intention regarding IHT.

Hitansh & Gupta, (2023) studied the factors influencing the adoption of digital marketing technologies in health service sector & investigate the challenges as well as efficacy of digital marketing in Indi Purposive sampling technique was used to gather data from an online survey of healthcare employees in India using a structured questionnaire based on 5-point Likert Scale. The study is based on a decomposed version of Technology Acceptance Model employing the PLS-SEM technique. Results revealed that both perceived usefulness and perceived challenges have a significant effect on attitude towards digital marketing and further the adoption of digital marketing technologies.

2.3 eHealth/health

Louis Leunga & Cheng Chenb, (2017) investigated the prevalence and patterns of e- health/m-health use in Hong Kong; & the activities that people engage in via health-related information plat-forms/apps;

and Data were collected from a telephone survey, with a probability sample of 1,007 respondents aged 18 or above. Our results show that 47.2% of the respondents were regular users of e-health technologies, 23.2% were m-health users and only 10.7% used wearables for health purposes. Among the six e-health/m-health activities identified, health tutorials and health information seeking were the most frequently used, followed by recording/monitoring and medical services. The least popular activities were reminders and sharing experiences. As expected, the component variables in the expectation-confirmation model, particularly confirmation and perceived usefulness, were the strongest predictors for lifestyle improvement.

Lapao & Dussault, (2017) in his paper illustrates how eHealth and mHealth can improve the delivery of services by the health workforce in response to increasing demands. Through a scoping literature review, the impact of eHealth/mHealth on the health workforce was assessed by examining how these technologies affect four dimensions of the performance of health professionals, according to the so-called QA: availability, accessibility, acceptability, and quality. The Researcher has identified Facilitators and barriers to the optimal utilization of eHealth and mHealth and categorized them as they relate to individuals, professional groups, provider organizations, and the institutional environment.

Louis Leunga, & Cheng Chenb, (2019) conducted the study to explore the roles of technology readiness, the expectation-confirmation model, and health-related information activities in predicting lifestyle improvement. Among the six e-health/m-health activities identified, health tutorials and health information seeking were the most frequently used, followed by recording/monitoring and medical services. The least popular activities were reminders and sharing experiences. As expected, the component variables in the expectation- confirmation model, particularly confirmation and perceived usefulness, were the strongest predictors for lifestyle improvement. External factors, such as being older and innovative, the use of e-health/m-health activities for recording/monitoring, health tutorials, medical services, and sharing experiences, also had significant impacts.

Alam. M, (2020) has examined the factors affecting the adoption of Health services in Bangladesh and also examined the moderating effect of gender on the intention to use and on the actual usage behaviour of users of health services. The extended Unified Theory of Acceptance and Use of Technology (UTAUT) model with perceived reliability and price value factors has been used to obtain first

objective. Structured face-to-face survey was employed and Structural equation modeling (SEM) with a partial least squares method was used to analyze the data collected to obtain the 2nd objective **.** Performance expectancy, social influence, facilitating conditions and perceived reliability positively influence the behavioural intention to adopt mHealth services. But effort expectancy and price value did not have a significant influence on the behavioural intention and Gender has a significant moderating effect on mHealth services adoption in certain cases.

Bhatt et al., (2020) build a relationship model involving the valid constructs linking m- Health and telemedicine adoption theory which describes the use of m-Health and telemedicine technology during the pandemic of Covid -19. For testing and confirmation of the theory, a three-step methodology has been applied. An extensive systematic literature review has been performed during the first stage, and a pool of items has been generated. This extensive literature review helped in finding out the theoretical support as well as in the generation of the model. The initial pool of items was reviewed by three academicians to check the initial relevance with the said constructs Physicians are not only able to give the advice based on the symptoms of a disease but are also able to share the preventive care as well as able to answer the queries of patient and advise them. With the help of a digital platform, a physician can share their knowledge and train each other. The study qualitatively validates the use of digital technology during the pandemic situation and develops the scale for the future empirical study.

2.4 EHR (Electronic Health Record)

Milstein et el., (2017) have analyzed whether hospitals use EHRs in advanced ways that are critical to improving outcomes, and whether hospitals with fewer resources – small, rural, safety-net – are keeping up. Using 2008–2015 American Hospital Association Information Technology Supplement survey data, the researcher has measured “basic” and “comprehensive” EHR adoption among hospitals. The Researchers then used new supplement questions to assess advanced use of EHRs and EHR data for performance measurement and patient engagement functions. To assess a digital “advanced use” divide, they ran logistic regression models to identify hospital characteristics associated with high adoption in each advanced use domain. They concluded that hospital EHR adoption is widespread and many hospitals are using EHRs to support performance measurement and patient engagement. However, this is not happening across all hospitals.

A. Hossain et al, (2018) identify the critical factors affecting the physicians' adoption of EHR in the healthcare system of Bangladesh by extending the Unified Theory of Acceptance and Use of Technology (UTAUT) to include Personal Innovativeness in Information Technology and Resistance to Change. A cross-sectional survey questionnaire was used to collect data from 300 participants in different private and public hospitals in Dhaka, the capital city of Bangladesh. The study used the partial least square (PLS) method, a statistical analysis technique based on the structural equation modeling (SEM), to analyze the collected data. The findings suggest that policymakers should increase the adoption of the EHR system by developing social strategies to encourage physicians to stimulate each other to use the EHR system and ensuring technical sufficiency, training to facilitate the use of the EHR system. In addition, the policymakers should identify physicians who possess a propensity to experiment with new information technologies as well as reduce existing challenges and barriers such as computers crush, poor infrastructure with erratic power supply etc. Moreover, we identify future research areas that provide scholars opportunities to push theoretical and empirical boundaries and offer further insights into the study of the EHR system.

3. Need of the Study

Digital technology gives healthcare providers an extensive view of patient health by significantly increasing access to health data and giving patients greater control over their health. The result may increase efficiency and can improve medical outcomes. The adoption of digital technology is essential in the healthcare sector as it contributes to better patient care, increased efficiency, cost savings, and innovation. It addresses many of the challenges faced by the healthcare industry while opening doors to new possibilities for research, diagnosis, and treatment. As healthcare continues to evolve, digital technology will play an increasingly central role in shaping its future.

4. Research Gap

Healthcare is a complex, highly personalized and costly service that is needed by everyone. Individual is required to give up his privacy while availing healthcare services. Despite various researches on numerous dimensions of information technology in healthcare, there is a need to study the challenges, issues and various effects of Digital Technology Adoption. Information and communication technologies (ICTs) for health have become key tools for healthcare services in public health. There is

a complete transformation in the way health information is being obtained and used due to the advancement of computer and communication technologies. A large number of studies have scrutinized the impact of health information technology (HIT) on various aspects of service. Still there is a strong need to provide a solution to the problem of scattered, poorly maintained, unorganized medical records of patients, which generally results in substandard medical service and inefficient utilization of available merger resources in developing countries. Healthcare services need continuous participation of the patients for effective delivery by the service provider. For that, trust and undoubted confidentiality have to be established by the service provider with the patient. As the use of information technology can raise doubts in the mind of the patient about the misuse of his personal information by any unauthorized entity, how trust influences the incorporation of IT in healthcare service needs to be explored.

5. Problem Statement

This study embarks on an exploration of the multifaceted landscape of digital technology adoption within the healthcare sector. It seeks to understand not only the advantages and opportunities presented by these technologies but also the nuances, obstacles, and potential risks they bring. The central aim of this research is to serve as a moderating force, guiding the healthcare sector towards harnessing the full potential of digital technology while ensuring that patient safety, data security, and ethical considerations remain at the forefront of this transformation.

6. Research Questions

The following research issues shall be addressed to fill the above-stated research gaps:

- What are the key factors influencing the adoption of digital health technology among healthcare providers?
- How does the level of digital technology adoption impact the quality of patient care and clinical outcome in healthcare sector?
- What are the economic implications of digital technology adoption in healthcare (including its impact on healthcare cost, resource allocation. reimbursement model)?
- What are the ethical consideration and patient perspectives on the adoption of digital technology in healthcare (digital data security)?

7. Objectives of the Study

Objective 1: To assess the impact of Digital Technology Adoption on operational efficiency of the healthcare sector.

Objective 2: To identify the challenges of Digital Technology Adoption in healthcare sector.

Objective 3: To analyse the healthcare Digital Data Security in Adoption of Digital Technology in healthcare.

Objective 4: To propose strategic Framework of effective Digital Technology Adoption in healthcare sector.

8. Research Hypotheses

The study will be carried out to test the following hypotheses. The hypotheses for the study are designed based on relevant literature:

H_0: There is no impact of Digital Technology Adoption on Healthcare Sector of India.

H_1: There is a impact of Digital Technology Adoption on Healthcare Sector of India

H_0: There is no significant effect of Macro Environmental factors on Digital technology Adoption in Healthcare sector.

H_1: There is a significant effect of Macro Environmental factors on Digital technology Adoption in Healthcare sector.

H_0: There is no significant effect of Micro Environmental factors on Digital technology Adoption in Healthcare sector.

H_1: There is a significant effect of Micro Environmental factors on Digital technology Adoption in Healthcare sector.

H_0: There is no significant impact of Digital Technology Adoption on operational efficiency of Healthcare sector.

H_1: There is a significant impact of Digital Technology Adoption on operational efficiency of Healthcare sector.

H_0: There is no significant relationship between Digital Technology Adoption and Digital Data Security in Healthcare sector.

H_1: There is a significant relationship between Digital Technology Adoption and Digital Data Security in Healthcare sector.

9. Conceptual Framework

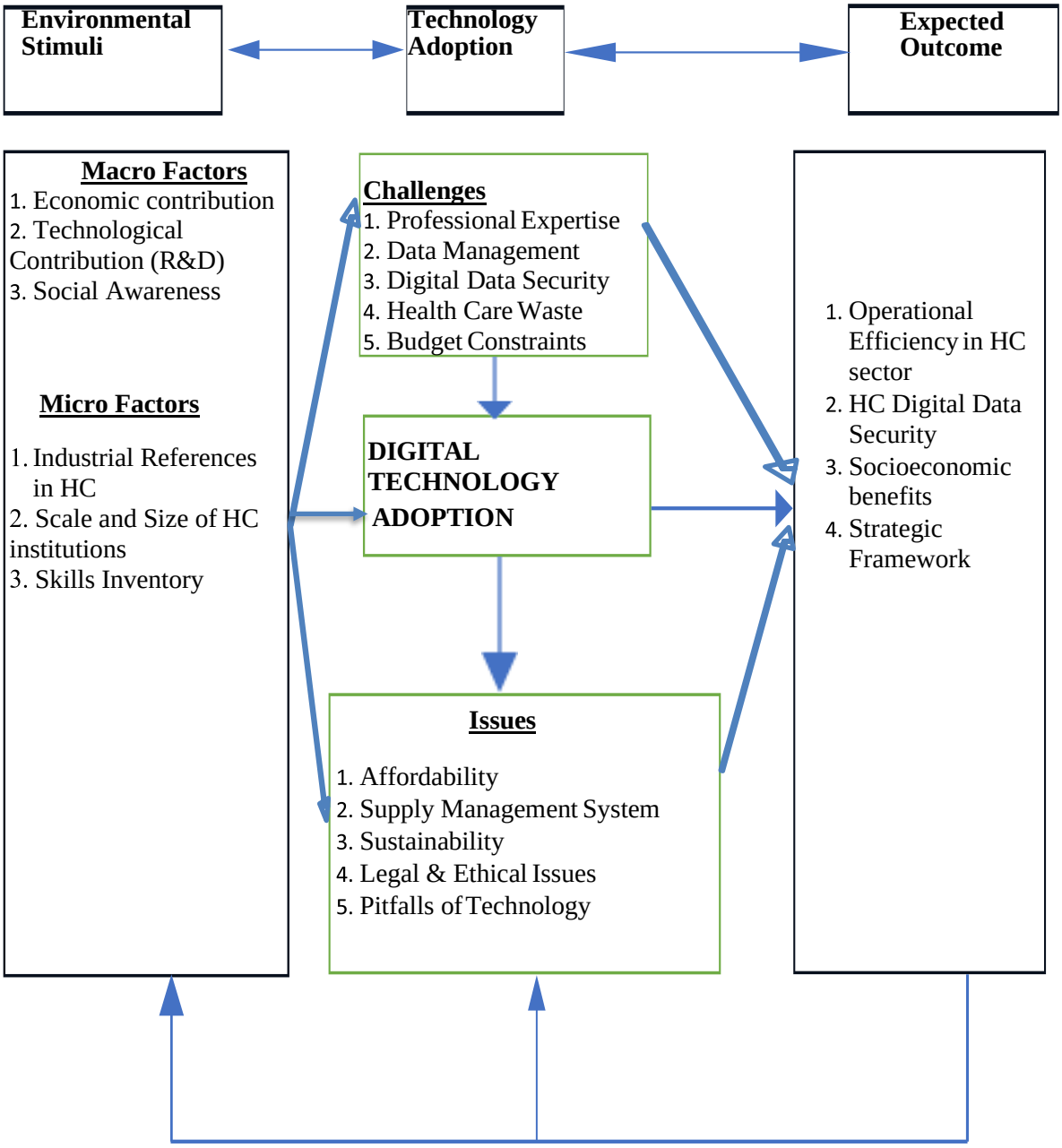

Figure 2: Conceptual Framework
(Source: Author's own Compilation)

In this Framework researcher has tried to embark the overall impact of Adoption of digital technologies on Macro and Micro Environmental factors and its expected outcome which will show an exploration of the multifaceted landscape of digital technology adoption within the healthcare sector. This framework is designed to serve as a moderating force, guiding the healthcare sector towards harnessing

the full potential of digital technology while mitigating challenges and issues on the expected outcome of the healthcare sector.

10. Research Methodology

10.1 Scope of the Study

The scope of the study will be confined to patients, healthcare providers (medical experts) and the programmed developers who are directly responsible in adopting digital technology in the healthcare sector from the State of **Uttar Pradesh.** The reason for choosing this state is that Uttar Pradesh has the highest number of populations in India so there will be more need for good healthcare infrastructure.

10.2 Research Design

The research design chosen for this study is **descriptive and analytical** in nature.

10.3 Sample Design

The research will employ two sampling techniques: non-probability judgmental sampling and snowball sampling.

10.4 Sample Size

The population from which the sample is to be drawn is infinite in nature. Using a statistical method for sample size computation, the following are the many quantitative measures to be taken into account.

I. Population characteristics that can vary or the standard deviation

II. Desired level of confidence or Z value (taken as 1.96 for desired 95% confidence level)

III. The level of accuracy needed when calculating population characteristics (D).

$n0 = \sigma 2. Z2 /D2$

Where, n0 = sample size

σ = Standard Deviation

Z = Standard normal variate for 95% confidence level and, D = Degree of precision desired

The outcomes of sample size from 3 situations are evaluated to acquire a representative and realistic sample size;

Scenario 1: Estimating a high standard deviation and low degree of precision.

Scenario 2: Estimating a moderate standard deviation and a moderate degree of precision.

Scenario 3: Estimating a low standard deviation and high precision.

Table 2: Comparative Analysis Taking Different Values of σ and D.

	σ	Z	D	n0
Scenario 1	**0.7**	**1.96**	**0.05**	**753**
Scenario 2	**0.6**	**1.96**	**0.06**	**384**
Scenario 3	**0.5**	**1.96**	**0.07**	**196**
Total				**1333**
Average				**444.33**

(Source: Author's own compilation)

The sample size calculated for the study is 444.33 with a 95% confidence level after taking the average of all three scenarios and considering them with varied values of σ and D.

10.5 Sample Composition

Information from the study will be gathered from the patients, healthcare providers (medical experts) and Programme Developers from the state of **Uttar Pradesh.** The selection of the state is based on population wise as it stands as the largest state of India- population-wise list. (Source: studyiq.com)

Table 3: Number of Hospitals

S.No.	State	Hospitals	Respondents
1.	**Uttar Pradesh**	10 Private Hospitals	444/20 = 22 approx. from each hospital
		10 Govt. Hospitals	444/20 = 22 approx. from each hospital

(Source: studyiq.com)

Table 4: List of Government Hospitals

S.NO.	HOSPITALS	DISTRICT
1	Ursula Horsman Memorial	Kanpur
2	M Kasiram Combined Hospital	Kanpur
3	Lok Bandhu Combined Hopsital	Lucknow
4	Tej Bhadur Sapru Hospital	Prayagraj
5	Babu Ishwar Sharan Hospital	Gonda
6	District Hospital(men's)	Azamgarh
7	District Hospital(men's)	Gorakhpur
8	Govt. Hospital Raipur	Raipur
9	Motilal Nehru Med College	Prayagraj
10	Balrampur Hospital Lucknow	Lucknow

(Source: times of India)

Table 5: List of Private Hospitals

S.NO.	HOSPITALS	DISTRICT
1	Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGI)	Lucknow
2	King George's Medical University (KGMU)	Lucknow
3	Dr. Ram Manohar Lohia Institute of Medical Sciences	Lucknow
4	Institute of Medical Sciences, Banaras Hindu University (IMS BHU)	Varanasi
5	Jawaharlal Nehru Medical College and Hospital, (JNMCH)	Aligarh

6	Shri Ram Murti Smarak Institute of Medical Sciences	Bareilly
7	U.P. Rural Institute of Medical Sciences & Research	Saifai, Etawah
8	Apollo Hospitals	Noida
9	Fortis Hospitals	Noida
10	Max Hospitals	Noida

(Source: adotrip.com)

10.6 Sources of Data Collection

Both primary and secondary methods of data collection will be used.

10.6.1 Primary data

Primary data enables customization and uniqueness to the current study. The researcher will have an open-ended questionnaire which will enhance the chances to gain a better insight into the psychology of the respondents. There will be a set of questions that will have to be filled by the respondents by themselves and hence it will give the researcher a better rendition of the core problems of research.

10.6.2 Secondary Data

Secondary data is readily available and eliminates the need for researchers to collect data from scratch. For the collection of secondary data, information will be gathered from a variety of periodicals, newspapers, websites, libraries, books, journals, blogs, and other published and unpublished sources.

10.7 Statistical Tools

To test the given hypothesis and survey findings scientifically, the researcher will analyse the data by using appropriate statistical tools like ANOVA (Analysis of Variance), Correlation Analysis, Regression Analysis, Partial least square and Structural Equation Modelling (PLS- SEM) to test the mediating effect.

10.8 Duration of the Study

The study will cover a period of three financial years. This extended time frame enables the research to capture trends, patterns, and changes in the phenomenon being studied over a significant duration. By examining data from five consecutive financial years, the study aims to provide a comprehensive and longitudinal perspective on the topic under investigation.

11. Implications of the Study

The implications of digital technology adoption in healthcare are profound, and they continue to evolve

as technology advances and healthcare systems adapt to new challenges and opportunities. While the benefits are substantial, it's essential to navigate these changes while addressing issues related to data security, privacy, and ethical considerations to ensure the highest standards of patient care and healthcare delivery.

Study will conclude the results in a meaningful way and suggestions will be proposed that will be helpful in better acceptance of digital technologies for delivering healthcare services.

12. Proposed Chapterization

The structure of the proposed research will be as follows:

Chapter 1: Introduction

Chapter 2: Review of Literature

Chapter 3: Research Methodology

Chapter 4: Analysis, findings and Results

Chapter 5: Conclusion and Directions for Future Research

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Appendix.1 Synthesized Matrix of Review of Literature

S. No	Authors	Digital Technologies	EHR (Electronic Health Record	m health	TAM (Technology Adoption Model)
1	Adler-Milstein(2015)		✓		
2	AlQudah, A. A(2021)				✓
3	AlHogail, A.,(2019)				✓
4	Alam, M. Z.(2020)			✓	
5	Bian, D(2023)	✓			
6	Bhatt, V(2020)	✓			
7	Bialas, C(2023)	✓			
8	Colicchio T.K.(2019)		✓		
9	Da Rosa(2021)	✓			
10	Gagnon M.P.(2009)	✓			
11	Golinelli, D(2020)	✓			
12	Gopal,G.(2019)	✓			
13	Gupta H.(2023)	✓			
14	Hossain, A(2019)		✓		
15	Ijaz, F.(2021)	✓			
16	Krick, T(2019)	✓			
17	Leung L.(2019)			✓	
18	Laurenza (2018)				✓
19	Lapão, L(2017)			✓	
20	Low, S. T.(2021)	✓			
21	Mosnaim, G. S(2020)	✓			
22	Nguyen, M., Fujioka(2020)				✓
23	Nikou, S(2020)	✓			
24	Rahimi, B(2018)				✓
25	Shinners L(2020)	✓			
26	Suresh V(2016)	✓			
27	Tortorella, G. L.(2021)	✓			
28	Tortorella, G. L(2020)	✓			

(Source: Author's own compilation)